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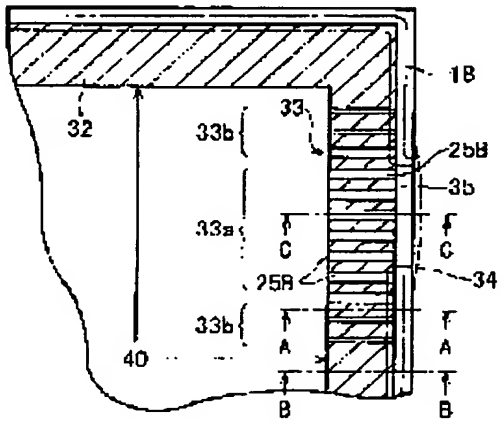
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a liquid crystal display device in which the period of injecting a liquid crystal can be reduced without degrading the appearance of the injection port.

SOLUTION: A square frame pattern 32 made of a black color layer is formed around a display region 40. The part of the frame pattern adjacent to and facing the injection port 35 for a liquid crystal formed in a sealing material 18 is formed as an injection guide part 33. The injection guide part is formed by alternately disposing the black color layer and another color layer having smaller film thickness than that of the black color layer. The injection guide part is formed longer than the injection port for the liquid crystal and extended over the both ends of the injection port for the liquid crystal. In the center part 33a of the injection guide, the black color layer and another color layer are disposed in 1:1 proportion, while a gradation region 33b with the proportion of the black color layer gradually increasing is formed in the both ends.



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CLAIMS

[Claim(s)]
[Claim 1] Two or more signal line and two or more scanning lines which have been arranged by crossing mutually on the 1 principal plane of a substrate, Two or more coloring layers arranged so that a part of switching element arranged for said every intersection, and said signal line, said scanning line and said switching element may be covered, [at least] Two or more pixel electrodes connected to said switching element through the through hole section formed in said coloring layer, respectively while being arranged in piles on said coloring layer, respectively, **** -- the bottom with a viewing area and the frame pattern which surrounds said viewing area, is prepared, has thickness thicker than said coloring layer and high protection-from-light nature, and prevents the optical leakage of said viewing-area periphery While surrounding the ******** array substrate, the opposite substrate which countered with said array substrate and has been arranged, and the perimeter of said viewing area, being prepared and having pasted up the periphery section comrade of said array substrate and said opposite substrate Two or more spacers which were formed between the sealant with a liquid crystal inlet, and said array substrate and said opposite substrate, and held the predetermined clearance between said array substrates and said opposite substrates, It has the liquid crystal layer poured into the gap between said array substrates and said opposite substrates from said liquid crystal inlet, and the sealing agent which closed said liquid crystal inlet. Said frame pattern The liquid crystal display characterized by having the impregnation guide section which carried out contiguity opposite in said liquid crystal inlet, and transposing some frame patterns [at least] to it by at least one of said the coloring layers in this impregnation guide section.
[Claim 2] The actuation circuit which said array substrate is formed in said switching element and coincidence, and drives said viewing area, Two or more wiring for being arranged in said viewing-area periphery at parallel, while being formed with the electric conduction film which constitutes said switching element and said actuation circuit, and operating said actuation circuit, The liquid crystal display according to claim 1 characterized by preparing at least one layer of the protection-from-light nature metal which constitutes said a part of switching element in the lower part of said coloring layer in a preparation and said impregnation guide section.
[Claim 3] The above-mentioned spacer is a liquid crystal display according to claim 1 or 2 characterized by having the pillar-shaped spacer simultaneously formed with the same protection-from-light nature ingredient as the above-mentioned frame pattern.
[Claim 4] Said array substrate is a liquid crystal display according to claim 3 characterized by having the pillar-shaped spacer formed on said some of [in said impregnation guide section / at least] coloring layers.
[Claim 5] A liquid crystal display given in claim 1 characterized by the height of the layer prepared in the lower part of a frame pattern being lower than the height of the layer prepared in the lower part of said coloring layer in said impregnation guide section of said frame pattern thru/or any 1 term of 4.
[Claim 6] It is a liquid crystal display given in claim 1 characterized by being shaded with the insulator layer which constitutes said switching element, and the film of protection-from-light nature thru/or any 1 term of 5 between said two or more wiring for said coloring layer being prepared caudad and operating a precursive actuation circuit in said impregnation guide part of said frame pattern.
[Claim 7] Said frame pattern is a liquid crystal display according to claim 1 characterized by being formed by [of said coloring layer] piling up two-layer at least.
[Claim 8] Said frame pattern and spacer are a liquid crystal display given in claim 1 characterized by

being formed of the black coloring layer thru/or any 1 term of 6.
[Claim 9] Said impregnation guide section is a liquid crystal display given in claim 1 characterized by having had bigger die length than the die length of said liquid crystal inlet, and having extended across the ends of a liquid crystal inlet thru/or any 1 term of 8.
[Claim 10] A liquid crystal display given in claim 1 characterized by arranging the frame pattern and said coloring layer together with alternation in said impregnation guide section of said frame pattern thru/or any 1 term of 9.
[Claim 11] Said impregnation guide section is a liquid crystal display according to claim 10 characterized by having the center section where the frame pattern and the coloring layer were located in a line by turns at same rate, and the gradation field where the frame pattern and said coloring layer were located in a line by turns so that the rate of a frame pattern might increase gradually while being located in the ends side of said center section, respectively.
[Claim 12] A liquid crystal display given in claim 1 characterized by arranging said frame pattern and said coloring layer pattern in the shape of a mosaic in said impregnation guide section of said frame pattern thru/or any 1 term of 9.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the liquid crystal display with which the coloring layer was prepared in the array substrate side about a liquid crystal display.
[0002]
[Description of the Prior Art] A liquid crystal display arranges two substrates which have the orientation film so that the orientation film may counter, between these two substrates, pinches a liquid crystal layer and is constituted. In order that boundary regions may be stuck and these two substrates may hold the distance between substrates to a predetermined value between these two substrates with a sealant and a sealing agent, the granular spacer or the pillar-shaped spacer which consists of resin formed by the photolithography method is arranged. When carrying out color display with a liquid crystal display, generally the coloring layer which becomes one side of a substrate from red (R), green (G), and blue (B) is arranged.
[0003] Usually, in order to prevent the optical leakage from a back light, a frame-like black matrix (BM) is formed in the outside of the viewing area of a substrate. As this BM ingredient, metal thin films, such as Cr and MoW, and resin are used.
[0004] Moreover, when forming a coloring layer in an array substrate side, a pillar-shaped spacer and a frame pattern are simultaneously formed in the black coloring layer other than each coloring layer of R, G, and B. A desired cel gap can be obtained by forming a black coloring layer on R, G, and the Bth place pigmented layer at this time. Usually, in order to obtain high permeability, R, G, and the Bth place pigmented layer are formed more thinly than a black coloring layer. Therefore, the cel gap in the part of a frame pattern is smaller than the cel gap in a viewing area.
[0005]
[Problem(s) to be Solved by the Invention] In such a liquid crystal display, liquid crystal is poured in between substrates through the inlet formed in a part of sealant. However, while a liquid crystal inlet carries out contiguity opposite with a frame pattern in this case and being located, as for this frame pattern, the cel gap has become [thickness] thick small. Therefore, liquid crystal will be poured in between substrates through a frame pattern with a small cel gap from an inlet, and will require time amount for impregnation of liquid crystal.
[0006] On the other hand, although impregnation time amount will become short since the opening cross section of an inlet becomes large if other coloring layers with thin thickness are arranged near the inlet, colors will differ with some frame patterns which counter an inlet, and the problem said that appearance worsens occurs.
[0007] This invention was made in view of the above point, and that object is to offer the liquid crystal display which can prevent lowering of the appearance of an inlet part while being able to aim at compaction of liquid crystal impregnation time amount.
[0008]
[Means for Solving the Problem] In order to attain the above-mentioned object, by equipping the liquid crystal display concerning this invention with the frame pattern prepared along the periphery edge of a viewing area, among this frame pattern, the part which carries out contiguity opposite arranges the thick coloring layer of thickness, and the thin coloring layer of thickness to a liquid crystal inlet, and is constituted.
[0009] Namely, two or more signal line and two or more scanning lines which have been arranged by

the liquid crystal display concerning this invention crossing mutually on the 1 principal plane of a substrate, Two or more coloring layers arranged so that a part of switching element arranged for said every intersection, and said signal line, said scanning line and said switching element may be covered, [at least] Two or more pixel electrodes connected to said switching element through the through hole section formed in said coloring layer, respectively while being arranged in piles on said coloring layer, respectively, **** -- the bottom with a viewing area and the frame pattern which surrounds said viewing area, is prepared, has thickness thicker than said coloring layer and high protection-from-light nature, and prevents the optical leakage of said viewing-area periphery While surrounding the ******** array substrate, the opposite substrate which countered with said array substrate and has been arranged, and the perimeter of said viewing area, being prepared and having pasted up the periphery section comrade of said array substrate and said opposite substrate Two or more spacers which were formed between the sealant with a liquid crystal inlet, and said array substrate and said opposite substrate, and held the predetermined clearance between said array substrates and said opposite substrates, It has the liquid crystal layer poured into the gap between said array substrates and said opposite substrates from said liquid crystal inlet, and the sealing agent which closed said liquid crystal inlet. Said frame pattern It is characterized by having the impregnation guide section which carried out contiguity opposite in said liquid crystal inlet, and transposing some frame patterns [at least] to it by at least one of said the coloring layers in this impregnation guide section.

[0010] While according to such a configuration the opening cross section of a liquid crystal inlet becomes large and being able to shorten liquid crystal impregnation time amount as compared with the case where all frame patterns are formed in a thick coloring layer, for example, a black coloring layer, by preparing the impregnation guide section in a frame pattern, the badness of the appearance by the colors of the impregnation guide section differing can also be eased.

[0011] On the other hand, when liquid crystal advances into the clearance between the substrates surrounded by the sealant, liquid crystal draws an arc and spreads. Therefore, the die length of the impregnation guide section of a frame pattern is formed for a long time than a liquid crystal inlet, and not only a liquid crystal inlet but the thing which the track of liquid crystal is securable, liquid crystal impregnation time amount is shortened, and the ratio of the thin coloring layer of thickness is stopped low, and is acquired for a good-looking liquid crystal display by extending and arranging on both sides further is possible.

[0012] Moreover, by forming a pillar-shaped spacer in the part on the coloring layer arranged at the impregnation guide section like the inside of a viewing area according to the liquid crystal display concerning this invention, it can prevent that a liquid crystal inlet collapses and a gap becomes narrow, and it becomes possible to shorten liquid crystal impregnation time amount more.

[0013] Furthermore, according to the liquid crystal display concerning this invention, it becomes possible to extend the gap of a liquid crystal inlet part further by making thinner than the thickness of the film which exists in the lower part for a thin coloring layer of thickness thickness of the film which exists in the lower part of the thick part of the thickness of the impregnation guide section.

[0014] Moreover, when according to the liquid crystal display concerning this invention a liquid crystal actuation circuit is formed around a viewing area at a switching element and coincidence and it has wiring for liquid crystal actuation ****** near the liquid crystal inlet, it sets. The clearance during wiring of the part which lapped with the coloring layer arranged at the impregnation guide section, and was located by shading combining two or more insulator layers which constitute a switching element and a liquid crystal actuation circuit, or a shading film Also in a wiring part, it becomes possible to arrange the thin coloring layer of thickness, and it becomes possible to improve liquid crystal impregnation time amount.

[0015] Furthermore, in the impregnation guide section, appearance improves further by arranging or arranging to a mosaic pattern so that a frame pattern and a coloring layer may become gradation.

[0016]

[Embodiment of the Invention] Hereafter, the active matrix liquid crystal display concerning the gestalt of implementation of this invention is explained to a detail, referring to a drawing. As shown in drawing 1 thru/or drawing 3 , a liquid crystal display 10 is equipped with the array substrate 12 with which the coloring layer as a light filter was prepared, and the opposite substrate 20 by which put the predetermined cel gap on this array substrate, and opposite arrangement was carried out, and the liquid crystal layer 70 is pinched between these array substrate and the opposite substrate.

[0017] The periphery sections are joined by the sealant 18 arranged so that the array substrate 12 and the

opposite substrate 20 may surround the periphery of the viewing area 40 of a liquid crystal display. The liquid crystal inlet 35 is formed in a part of sealant 18, and this liquid crystal inlet 35 is closed with the sealing agent 34 after liquid crystal impregnation.

[0018] The opposite substrate 20 forms in order the transparent electrode 22 and the orientation film 13 which consist of ITO on the transparence substrate 21 which consists of glass, and is constituted.

[0019] Moreover, the auxiliary capacity electrode prepared in two or more scan electrodes and this which are not illustrated on the transparence substrate 11 with which the array substrate 12 consists of glass, and parallel, And the TFT (thin film transistor) component of the Nch mold LDD structure which two or more signal lines 14 which intersect perpendicularly with these through an insulator layer 23 are arranged, and is not illustrated as a switching element near [intersection] each [of the scanning line and a signal line], The source electrode 15 connected to this switching element and an electric target, the pixel electrode 30 connected to this source electrode, and ** are arranged.

[0020] Moreover, on the transparence substrate 11 of the array substrate 12, the liquid crystal actuation circuit which is not illustrated is formed around viewing-area 40, and two or more wiring 16 required in order to operate this liquid crystal actuation circuit is formed in a switching element and coincidence near the viewing area.

[0021] And the protection insulator layer 24 is formed so that a switching element and a liquid crystal actuation circuit may be covered, and coloring layer 25G of stripe-like green (G), blue (B) coloring layer 25B, and red (R) coloring layer 25R are arranged further in the upper part, respectively. And the green edges on both sides of coloring layer 25G are covered with blue coloring layer 25B or red coloring layer 25R. Such a configuration is attained by producing so that the protection-from-light mask used in case each coloring layer is processed may be suited.

[0022] And the pixel electrode 30 is arranged on these coloring layers 25G and 25B and 25R, respectively, and is connected to the source electrode 15 of a switching element which corresponds through the through hole 26 formed at the coloring layer and the protection insulator layer 24, respectively. Furthermore, all over the glass substrate 11 substrate, the orientation film 13 is formed so that the pixel electrode 30 and the coloring layers 25G, 25B, and 25R may be covered. Ultraviolet curing mold acrylic resin is used for a coloring layer ingredient, and polyimide is used for the orientation film ingredient, respectively.

[0023] Moreover, on the glass substrate 11 of the array substrate 12, the frame pattern 32 of the shape of a rectangle which consists of a black coloring layer with predetermined width of face is formed so that the periphery of a viewing area 40 may be surrounded. This frame pattern 32 is formed more thickly than other coloring layers 25G, 25B, and 25R. Furthermore, simultaneously with this frame pattern 32, on the pixel electrode 30, many pillar-shaped spacers 31 are formed by the desired consistency. The part is in the condition which lapped with the frame pattern 32, and the sealant 18 is formed in the periphery section of a viewing area 40.

[0024] And while the periphery sections have pasted up the array substrate 12 and the opposite substrate 20 by the sealant 18, the cel gap between these substrates is maintained by the predetermined value with many pillar-shaped spacers 31.

[0025] In the frame pattern 32, the part which carries out contiguity opposite with the liquid crystal inlet 35 of a sealant 18 is formed as the impregnation guide section 33. That is, the impregnation guide section 33 is formed the black coloring layer which constitutes the frame pattern 32, other coloring layers thinner than this black coloring layer, for example, blue coloring layer 25B, and by preparing by turns.

[0026] The impregnation guide section 33 had die-length L of about 1.4 of the die length of the liquid crystal inlet 35, and has extended across the ends of a liquid crystal inlet. And in center-section 33a of the impregnation guide section 33, the black coloring layer and blue coloring layer of the same width of face are prepared by turns at a rate of 1:1, and the width of face of a black coloring layer is gradually large, and the width of face of a blue coloring layer becomes small gradually, and, at both ends, has become the so-called gradation field 33b.

[0027] Next, the manufacture approach of the active matrix liquid crystal display of the above-mentioned configuration is explained. First, about 50nm of a-Si film is put with a CVD method etc. on the translucency insulation substrates 11, such as a high strain point glass substrate and a quartz substrate. After performing furnace annealing for this at 450 degrees C for 1 hour, XeCl excimer laser is irradiated, the a-Si film is polycrystal-ized, and it considers as the polish recon film. After that, pattern NINGU of the polish recon film is carried out by the photograph engraving method, the channel layer of

TFT of the picture element part in a viewing area which is not illustrated and the channel layer of TFT (circuit TFT) of a liquid crystal actuation circuit field which is not illustrated are formed, and the lower electrode of an auxiliary capacitative element is formed further.
[0028] Next, about 100nm of silicon oxide used as the gate dielectric film which is not illustrated all over an insulating substrate 11 with a CVD method is put. Then, about 400nm of a simple substance, its cascade screen, or alloy film, such as Ta, Cr, aluminum, Mo, W, and Cu, are put all over this silicon oxide top, patterning is carried out to a predetermined configuration by the photograph engraving method, and the scanning line illustrating neither, the gate electrode of the pixel TFT which extends and changes the scanning line and an auxiliary capacity line, the gate electrode of Circuit TFT, and various wiring in an actuation circuit field are formed. At this time, the wiring 16 which is needed in order to make a liquid crystal actuation circuit drive is also formed simultaneously.
[0029] Then, an impurity is injected into the channel layer mentioned above by the ion implantation or the ion doping method by using these gate electrodes as a mask, and the source electrode 15 of Pixel TFT, the drain electrode which is not illustrated, and the source electrode and drain electrode of Circuit TFT of a Nch mold which is not illustrated are formed. Impregnation of an impurity is the dose of 5x1015 atoms/cm2 in acceleration voltage 80keV, and carried out high concentration impregnation of Lynn by PH3/H2.
[0030] Next, after covering with a resist so that an impurity may not be poured into the circuit TFT of the Nch mold of the pixel TFT which is not illustrated and an actuation circuit field, by using as a mask the gate electrode of the circuit TFT of the Pch mold which is not illustrated, with the dose of 5x1015 atoms/cm2, high concentration impregnation of the boron is carried out by B-2s PH6/H2, and the source electrode and drain electrode of Circuit TFT of a Pch mold are formed by acceleration voltage acceleration voltage 80keV, respectively.
[0031] Then, impurity impregnation for forming the Nch mold LDD (Lightly Doped Drain) which is not illustrated is performed, and an impurity is activated by annealing a substrate.
[0032] Furthermore, about 500nm of interlayer insulation films 23 which consist of silicon oxide all over an insulating substrate 11, for example using the PECVD method is put.
[0033] Then, the contact hole 26 which results in the source electrode 15 of Pixel TFT, the contact hole which results in the drain electrode which is not illustrated, and the contact hole which results in the source electrode and drain electrode of Circuit TFT which are not illustrated are formed by the photo etching method, respectively.
[0034] Next, about 500nm of a simple substance, its cascade screen, or alloy film, such as Ta, Cr, aluminum, Mo, W, and Cu, were put, patterning was carried out to the predetermined configuration by the photograph engraving method, and various kinds of wiring of the circuit TFT in the drain electrode of the 14 pixel signal line TFT, the source electrode 15, and the liquid crystal actuation circuit field that is not illustrated etc. was performed.
[0035] At this time, in the part except the liquid crystal inlet 35 and the part which counters, wiring 16 which is needed in order to operate a liquid crystal actuation circuit was considered as the same two-layer wiring as the former, as shown in drawing 4 . Moreover, in the liquid crystal inlet 35 and the impregnation guide section 33 which counters, in the part in which blue coloring layer 25B is prepared, as shown in drawing 5 , wiring 16 is considered as a gate line and wiring of only one layer formed in coincidence, and the protection-from-light pattern 17 which prevents optical leakage is formed through an interlayer insulation film 23 in piles between the adjoining wiring 16. Furthermore, in the impregnation guide section 33, about the field where the black coloring layer has been arranged, as shown in drawing 3 , wiring 16 is made into monolayer structure, and it is considering as the structure except an interlayer insulation film 23.
[0036] Next, the protection insulator layer 24 which consists of SiNx all over an insulating substrate 11 by the PECVD method is formed, and the contact hole 26 which results in the pixel electrode 30, respectively is formed by the photograph engraving method.
[0037] Then, ultraviolet curing mold acrylic green resist liquid is applied by about 2-micrometer thickness by spinner spreading on the insulating substrate 11 in which the pixel electrode 30 was formed. Then, it prebakes for about 5 minutes at about 90 degrees C, and exposes by the ultraviolet rays of the reinforcement of 150 mJ/cm2 using a predetermined mask pattern. The photo-mask pattern used here has the circular pattern with a diameter of 15 micrometers as a contact hole 26 for connecting the stripe configuration pattern corresponding to green stain layer 25G, and the pixel electrode 30 and the source electrode 15.

[0038] Then, green stain layer 25G which have a contact hole 26 were formed by developing negatives for about 60 seconds using about 0.1% of the weight of a TMAH (tetramethylammonium hydride) water solution, and carrying out postbake at about 20 degrees C after washing in cold water further for about 1 hour.
[0039] Then, blue coloring layer 25B and red coloring layer 25R are formed at the same process. Under the present circumstances, it considered as the configuration the pattern edge of green stain layer 25G is covered with whose blue coloring layer 25B and red coloring layer 25R. This is attained by producing so that the exposure mask used as mentioned above in case each coloring layer is processed may be suited.
[0040] Next, an indium and a tin oxide (ITO) are deposited by the sputtering method on the coloring layers 25R and 25G and 25B, and the pixel electrode 30 is formed by carrying out patterning of this.
[0041] Then, the pillar-shaped spacer 31 and the frame pattern 32 are formed by the black coloring layer. The frame pattern 32 is formed in the viewing-area 40 circumference part except the liquid crystal inlet 35 by fixed width of face, and is formed in a liquid crystal inlet at the part 33 which carries out contiguity opposite, i.e., the impregnation guide section.
[0042] In the impregnation guide section 33, by center-section 33a, a black coloring layer and blue coloring layer 25B have been arranged by turns by 50-micrometer width of face, and it arranges so that the rate of surface ratio may be set to 1:1. At the both ends of the impregnation guide section 33, the rate of a black coloring layer was increased gradually and it was referred to as gradation field 33b as the edge was approached.
[0043] In the impregnation guide section 33, as shown in drawing 5 , it arranges, either 24, for example, the protection insulator layer, of the shading film which forms a switching element, and considers as the structure where optical leakage does not take place at the lower part of a part, by which blue coloring layer 25B has been arranged. Furthermore, in the impregnation guide section 33, the pillar-shaped spacer 31 is arranged at same rate as the inside of a viewing area 40 on blue coloring layer 25B.
[0044] Then, spreading and orientation processing were performed for the orientation film ingredient which consists of polyimide all over insulating-substrate 11, the orientation film 13 was formed, and this obtained the array substrate 11 which has a light filter.
[0045] Opposite substrate 20 ** is obtained by depositing ITO on the thickness of about 100nm by the spatter, forming a counterelectrode 22, performing spreading and orientation processing for the orientation film ingredient which consists of polyimide continuously all over a substrate, and on the other hand, forming the orientation film 13 on the transparence insulating substrate 21.
[0046] Thus, a sealant 18 is applied to the periphery edge of the formed opposite substrate 20 except for the liquid crystal inlet 35. The cel of an empty condition is completed by sticking this opposite substrate 20 and the array substrate 12 with which the light filter was prepared by the sealant 18.
[0047] Next, vacuum impregnation of the pneumatic liquid crystal ingredient with which chiral material was added is carried out into a cel from the liquid crystal inlet 35, and the liquid crystal inlet 35 is closed after impregnation using the ultraviolet-rays hardening resin as a sealing agent 33. Then, a liquid crystal display is completed by sticking a polarizing plate on the both sides of a cel, respectively.
[0048]

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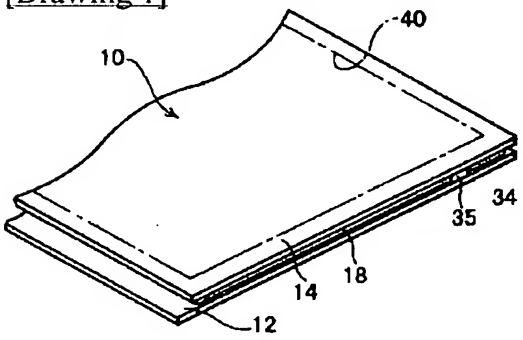
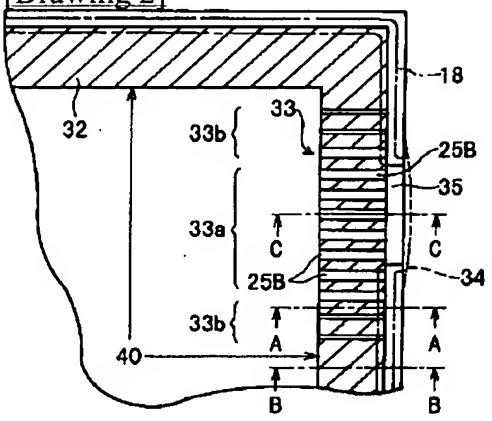
DRAWINGS

[Drawing 1]



[Drawing 2]



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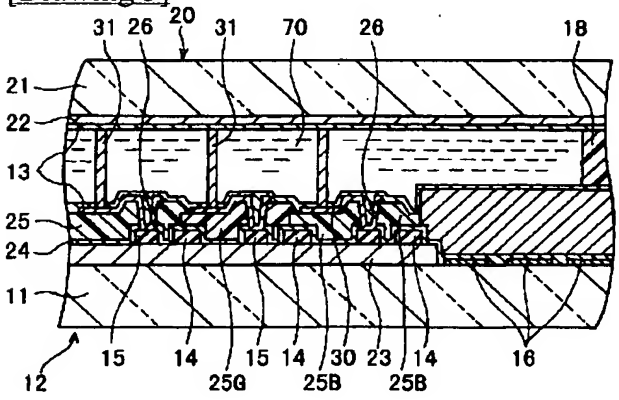

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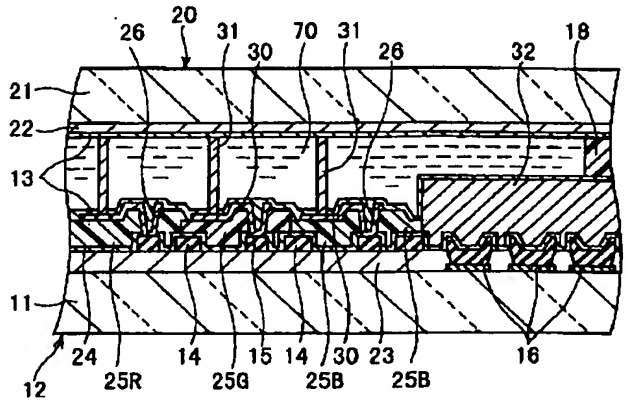

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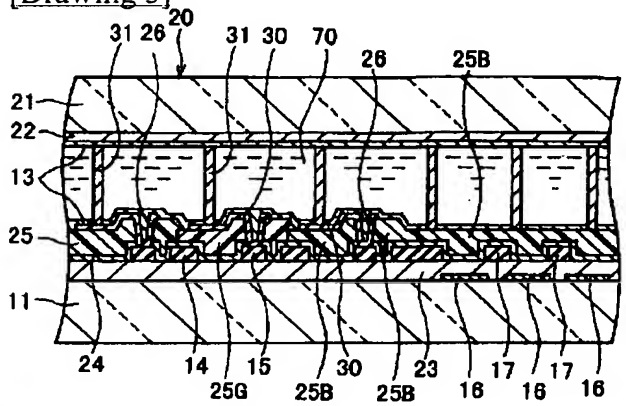

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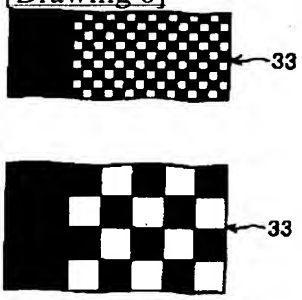

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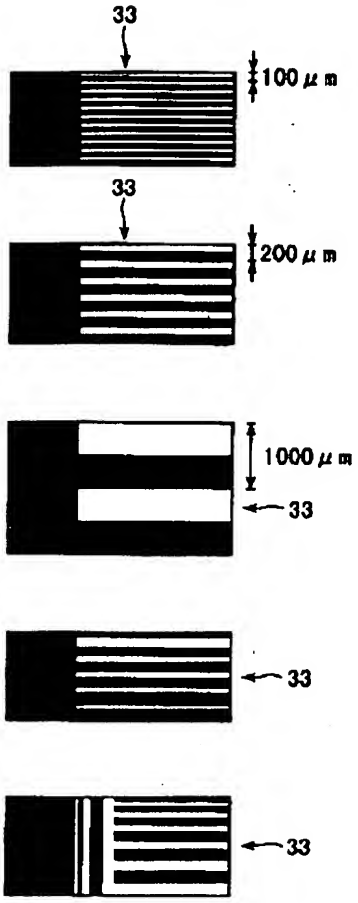

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